

# THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY

Vol. 143, No. 5, May 2012

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### Presidential Perspectives

#### 1003 Historical perspectives of The American Association for Thoracic Surgery: Robert Edward Gross (1905–1988)

*Joseph W. Turek, MD, PhD, and J. William Gaynor, MD, Iowa City, Iowa, and Philadelphia, Pa*

### Acquired Cardiovascular Disease (ACD)

#### 1007 Less invasive surgical treatment for aortic arch aneurysms in high-risk patients: A comparative study of hybrid thoracic endovascular aortic repair and conventional total arch replacement

*Takashi Murashita, MD, Hitoshi Matsuda, MD, Keitaro Domae, MD, Yutaka Iba, MD, Hiroshi Tanaka, MD, Hiroaki Sasaki, MD, and Hitoshi Ogino, MD, Osaka, Japan*

A less invasive hybrid procedure involving supra-aortic bypass and endovascular stent-graft placement for aortic arch aneurysms was indicated in high-risk patients. The impact of this procedure was assessed by evaluating the early and midterm outcomes compared with those of conventional total arch replacement.

#### 1014 Simplified perfusion strategy for removing retroperitoneal tumors with extensive cavoatrial involvement

*Jose L. Navia, MD, Nicolas A. Brozzi, MD, Edward R. Nowicki, MD, MS, Eugene H. Blackstone, MD, Venkatesh Krishnamurthi, MD, Martin G. Sinkewich, CCP, Jeevanantham Rajeswaran, MSc, Gregory Pattakos, MD, MS, and Bruce W. Lytle, MD, Cleveland, Ohio*

Radical nephrectomy and removal of retroperitoneal tumor–thrombus with extensive cavoatrial involvement can be performed simply, effectively, and safely with beating-heart cardiopulmonary bypass, avoiding the deleterious effects of hypothermic circulatory arrest and providing clinical benefit without increasing morbidity or mortality.

#### 1022 A phase 2 prospective, randomized, double-blind trial comparing the effects of tranexamic acid with ecallantide on blood loss from high-risk cardiac surgery with cardiopulmonary bypass (CONSERV-2 Trial)

*Paula M. Bokesch, MD, Gabor Szabo, MD, Ryszard Wojdyga, MD, Hilary P. Grocott, MD, FRCPC, Peter K. Smith, MD, C. David Mazer, MD, FRCPC, Santosh Vetticaden, MD, PhD, Alistair Wheeler, MD, and Jerrold H. Levy, MD, FAHA, Lexington and Boston, Mass; Heidelberg, Germany; Warsaw, Poland; Winnipeg, Manitoba, and Toronto, Ontario, Canada; Durham, NC; and Atlanta, Ga*

This prospective multinational, randomized, double-blind trial compared the efficacy of ecallantide with tranexamic acid to decrease blood transfusion in patients undergoing cardiac surgery by using cardiopulmonary bypass for procedures associated with a high risk of bleeding. Ecallantide was less effective at reducing perioperative blood loss than tranexamic acid. High-dose tranexamic acid was more effective than the low dose in reducing blood loss.

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ACD

CHD

GTS

ET/BS

TX

PM

## 1030 Coronary perfusion: Impact of flow dynamics and geometric design of 2 different aortic prostheses of similar size

Vito Mannacio, MD, Luigi Di Tommaso, MD, Vincenzo De Amicis, MD, Paolo Stassano, MD, and Carlo Vosa, MD, Naples, Italy

This study compared 2 similarly sized aortic prostheses (mechanical and porcine) regarding coronary flow and hemodynamic performance after surgery for pure aortic stenosis. Conclusions were that bioprostheses showed more evident improvement of coronary flow and superior hemodynamics during exercise.

## 1036 Beneficial effects of the CorCap cardiac support device: Five-year results from the Acorn Trial



Douglas L. Mann, MD, Spencer H. Kubo, MD, Hani N. Sabbah, PhD, Randall C. Starling, MD, Mariell Jessup, MD, Jae K. Oh, MD, and Michael A. Acker, MD, St Paul and Rochester, Minn; Detroit, Mich; Cleveland, Ohio; Philadelphia, Pa; and St Louis, Mo

This report of 5-year follow-up of the non-mitral valve repair stratum of the Acorn Trial shows that treatment with a cardiac support device was safe in long-term follow-up and that there were continued significant reductions in LV end-diastolic volume and structure and an improvement in NYHA class.

## 1043 Tricuspid valve surgery: The past 10 years from the Nationwide Inpatient Sample (NIS) database

Christina M. Vassileva, MD, John Shabosky, BA, Theresa Boley, MSN, Stephen Markwell, MA, and Stephen Hazelrigg, MD, Springfield, Ill

There has been a dramatic increase in tricuspid interventions over time, with associated increase in tricuspid repair rates and use of bioprostheses for tricuspid replacement. Mortality for tricuspid valve surgery decreased over time. Nevertheless, mortality remains considerable (10.6% overall) and significantly higher for replacement than for repair.

## 1050 Increased risk of dehiscence after tricuspid valve repair with rigid annuloplasty rings

Bettina Pfannmüller, MD, Torsten Doenst, MD, PhD, Katja Eberhardt, BS, Jörg Seeburger, MD, Michael A. Borger, MD, PhD, and Friedrich W. Mohr, MD, PhD, Leipzig, Germany

Surgical correction of tricuspid regurgitation mainly consists of tricuspid valve annuloplasty, performed with either a rigid ring or a flexible band. Our analysis revealed that although acceptable results can be achieved with either annuloplasty device, implantation of a rigid ring increases the risk of postoperative ring dehiscence.

## 1056 Multivessel beating heart robotic myocardial revascularization increases morbidity and mortality

Richa Dhawan, MD, Joseph Devin Roberts, MD, Kristen Wroblewski, MS, Jeffrey A. Katz, MD, Jai Raman, MD, PhD, and Mark A. Chaney, MD, Chicago, Ill

The present retrospective review of 106 patients undergoing total endoscopic coronary artery bypass (72% multivessel) indicates that addressing multivessel coronary artery disease using this technology might increase the morbidity and mortality.

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## 1062 Fifteen-year experience with minimally invasive approach for reoperations involving the mitral valve

*Joseph M. Arcidi, Jr, MD, Evelio Rodriguez, MD, Joseph R. Elbeery, MD, L. Wiley Nifong, MD, Jimmy T. Efird, PhD, and W. Randolph Chitwood, Jr, MD, Greenville, NC*

In 15 years, we performed minimally invasive right thoracotomy for 167 reoperations involving the mitral valve to avoid reoperative sternotomy risk. Mitral repair rate and procedure complexity increased with experience. Mortality and stroke rate were 3.0% and 2.4%, respectively; there was no statistical relationship with fibrillatory arrest, used in 77%.

## Congenital Heart Disease (CHD)

## 1069 Differential effects of aprotinin and tranexamic acid on outcomes and cytokine profiles in neonates undergoing cardiac surgery

*Eric M. Graham, MD, Andrew M. Atz, MD, Jenna Gillis, MS, Stacia M. DeSantis, PhD, A. Lauren Haney, PharmD, Rachael L. Deardorff, MS, Walter E. Uber, PharmD, Scott T. Reeves, MD, Francis X. McGowan, Jr, MD, Scott M. Bradley, MD, and Francis G. Spinale, MD, PhD, Charleston, SC*

Aprotinin, compared with tranexamic acid, was associated with reduced perioperative blood product use, improved early indices of postoperative recovery, and attenuated proinflammatory cytokine production, without apparent early adverse effects in neonates undergoing cardiac operations.

## 1077 The improvement of hypoxia correlates with neuroanatomic and developmental outcomes: Comparison of midterm outcomes in infants with transposition of the great arteries or single-ventricle physiology

*Keiichi Ibuki, MD, Kazuhiro Watanabe, MD, Naoki Yoshimura, MD, Tachiyo Kakimoto, MA, Mie Matsui, MD, Taketoshi Yoshida, MD, Hideki Origasa, PhD, and Fukiko Ichida, MD, Toyama, Japan*

Neuroanatomic and developmental outcomes improve progressively in infants with TGA, unlike those with SV physiology. Neurodevelopmental assessment scores are positively associated with regional brain volume, and functional oxygen saturation is associated with whole and frontal brain volumes. Impaired cerebral circulation and hypoxia may have significant effects on brain growth and development in infants with congenital heart disease.

## 1086 Hepatic blood flow distribution and performance in conventional and novel Y-graft Fontan geometries: A case series computational fluid dynamics study

*Weiguang Yang, MS, Irene E. Vignon-Clementel, PhD, Guillaume Troianowski, MS, V. Mohan Reddy, MD, Jeffrey A. Feinstein, MD, MPH, and Alison L. Marsden, PhD, La Jolla and Stanford, Calif; and Le Chesnay Cedex, France*

The Y-graft Fontan design achieves overall superior hemodynamic performance compared with traditional designs. However, the results emphasize that no one-size-fits-all solution is available that will universally benefit all patients and that designs should be customized for individual patients before clinical application.

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## 1098 Coarctectomy combined with an interdigitating arch reconstruction results in a lower incidence of recurrent arch obstruction after the Norwood procedure than coarctectomy alone



Luke J. Lamers, MD, Peter C. Frommelt, MD, Kathleen A. Mussatto, RN, PhD, Robert D. B. Jaquiss, MD, Michael E. Mitchell, MD, and James S. Tweddell, MD, Milwaukee, Wis

In this retrospective study of 142 Norwood procedures, 2 techniques of arch reconstruction were compared: coarctectomy alone (n = 79) versus coarctectomy plus an interdigitating arch anastomosis (n = 63). Coarctectomy plus an interdigitating arch anastomosis resulted in a decreased incidence of intervention for recurrent arch obstruction ( $P = .001$ ).

## 1103 Long-term importance of right ventricular outflow tract patch function in patients with pulmonary regurgitation

Rajesh Puranik, MD, Victor Tsang, MD, Philip Lurz, MD, Vivek Muthurangu, MD, Sophie Offen, MBBS, Alessandra Frigiola, MD, Wendy Norman, DCR, Fiona Walker, MD, Philip Bonhoeffer, MD, and Andrew M. Taylor, MD, London, United Kingdom

RVOT patch dysfunction is an important determinant of long-term outcomes in ToF. Patients with a similar degree of pulmonary regurgitation secondary to pulmonary stenosis treated with valvotomy have more favorable ventricular volumes and contractile function. These observations highlight the importance of the initial repair surgery in ToF for late outcomes.

## 1108 Visualization of flow structures in Fontan patients using 3-dimensional phase contrast magnetic resonance imaging



Kartik S. Sundareswaran, PhD, Christopher M. Haggerty, BS, Diane de Zélicourt, PhD, Lakshmi P. Dasi, PhD, Kerem Pekkan, PhD, David H. Frakes, PhD, Andrew J. Powell, MD, Kirk R. Kanter, MD, Mark A. Fogel, MD, and Ajit P. Yoganathan, PhD, Atlanta, Ga; Fort Collins, Colo; Pittsburgh and Philadelphia, Pa; Tempe, Ariz; and Boston, Mass

Comparisons of in vivo 3D hemodynamics were made between lateral tunnel and extracardiac Fontan connections using magnetic resonance imaging. Results demonstrated distinctive differences in the qualitative flow features: lateral tunnels generally exhibiting large recirculation regions, whereas extracardiatics had a more streamlined profile.

## 1117 Changes in left atrioventricular valve geometry after surgical repair of complete atrioventricular canal

Elisabeth Kaza, MD, Gerald R. Marx, MD, Aditya K. Kaza, MD, Steven D. Colan, MD, Hugo Loyola, MS, Douglas P. Perrin, PhD, and Pedro J. del Nido, MD, Boston, Mass

This study sought to determine the changes in left atrioventricular valve geometry that affect leaflet coaptation after surgical repair using 2-dimensional echocardiographic imaging and quantification.



## General Thoracic Surgery (GTS)

## 1125 The use of a tailored surgical technique for minimally invasive esophagectomy

Jeffrey Javidfar, MD, Matthew Bacchetta, MD, Jonathan A. Yang, MD, MPH, Joanna Miller, BS, Frank D'Ovidio, MD, PhD, Mark E. Ginsburg, MD, Lyall A. Gorenstein, MD, Marc Bessler, MD, and Joshua R. Sonett, MD, New York, NY

When the surgical technique (transhiatal, transthoracic, or 3-hole) for minimally invasive esophagectomy is tailored to the anatomy and oncologic needs of each patient, it can be performed safely while maintaining oncologic equivalence and providing comparable lymph node dissection.

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- 1130 Evolving progress in oncologic and operative outcomes for esophageal and junctional cancer: Lessons from the experience of a high-volume center**    
*John V. Reynolds, MD, Claire L. Donohoe, MB, Erin McGillicuddy, MSc, Narayamasamy Ravi, MD, Dermot O'Toole, MD, Ken O'Byrne, MD, and Donal Hollywood, MD, Dublin, Ireland*

Modern benchmarks in esophageal cancer management include (1) a cure rate of approximately 40% in patients treated with curative intent and (2) low postoperative mortality rates. This study of 1067 patients highlights evolving trends, including changes in patterns of care, an increase in early diagnoses, higher nodal yields, and an increased use of nonoperative approaches.

- 1138 Operative techniques in robotic thoracic surgery for inferior or posterior mediastinal pathology**  
*Robert James Cerfolio, MD, FACS, FCCP, Ayesha S. Bryant, MSPH, MD, and Douglas J. Minnich, MD, FACS, Birmingham, Ala*

Robotic surgery is safe and effective for pathology in the inferior or posterior mediastinum and for anterior mediastinal tumors. Our experience in 75 such patients is reviewed. The different technical maneuvers, such as alterations in patient positioning and robotic orientation that optimize the operation, are related.


- 1144 Thoracic empyema in patients with liver cirrhosis: Clinical characteristics and outcome analysis of thoracoscopic management**  
*Ke-Cheng Chen, MD, Jou-Wei Lin, MD, MPH, PhD, Yu-Ting Tseng, MD, Shuenn-Wen Kuo, MD, Pei-Ming Huang, MD, Hsao-Hsun Hsu, MD, PhD, Jang-Ming Lee, MD, PhD, and Jin-Shing Chen, MD, PhD, Yun-Lin County, Hsin-Chu County, and Taipei, Taiwan*

Management of thoracic empyema in cirrhotic patients is a clinical challenge and associated with a high mortality. Our study showed that, with proper patient selection, thoracoscopic management is feasible and may provide a better chance of survival than nonthoracoscopic management.

## Evolving Technology/ Basic Science (ET/BS)

- 1152 Nanocoating with titanium reduces iC3b- and granulocyte-activating immune response against glutaraldehyde-fixed bovine pericardium: A new technique to improve biologic heart valve prosthesis durability?**  
*Norbert W. Guldner, MD, Fabienne Bastian, MD, Günther Weigel, MD, Hannörg Zimmermann, MS, Markus Maleika, MS, Michael Scharfswerd, MS, Daniel Rohde, MS, and Hans-Hinrich Sievers, MD, Lübeck and Nürnberg, Germany; and Vienna, Austria*

Nanocoating with titanium significantly reduces the iC3b to  $38\% \pm 21\%$  and the granulocyte-activating immune response of GA-fixed pericardium to 6.3%. Therefore, it might prevent relevant immune rejections and might increase the durability of GA-fixed bio-prosthetic heart valves and enable the use of GA-fixed valves even in young patients.

- 1160 Clinical implications and molecular mechanisms of immunoparalysis after cardiopulmonary bypass**   
*Timothy T. Cornell, MD, Lei Sun, PhD, Mark W. Hall, MD, James G. Gurney, PhD, Matthew J. Ashbrook, BS, Richard G. Ohye, MD, and Thomas P. Shanley, MD, Ann Arbor, Mich, and Columbus, Ohio*

We used an ex vivo whole blood stimulation assay to immunophenotype pediatric patients after cardiopulmonary bypass. This assay allowed us to identify a cohort of patients at low risk for developing postoperative infections.

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## 1167 The nondepolarizing, normokalemic cardioplegia formulation adenosine-lidocaine (adenocaine) exerts anti-neutrophil effects by synergistic actions of its components

*Weiwei Shi, MD, PhD, Rong Jiang, MD, PhD, Geoffrey P. Dobson, PhD, Asger Granfeldt, MD, and Jakob Vinten-Johansen, PhD, Atlanta, Ga, Townsville, Australia, and Aarhus, Denmark*

The combination of adenosine and lidocaine (adenocaine; Hibernation Therapeutics Global Ltd, Kilquade, Ireland) is used in cardioplegia to arrest the heart in a polarized state or at lower concentrations to reduce potassium required to achieve arrest. This study shows that adenocaine also exerts anti-inflammatory effects directly on neutrophils by suppressing superoxide anion generation and adhesion molecule expression in isolated porcine neutrophils to a greater extent than either drug alone.

## 1176 Creating an ideal “off-test mode” for rotary left ventricular assist devices: Establishing a safe and appropriate weaning protocol after myocardial recovery

*Masahiko Ando, MD, PhD, Takashi Nishimura, MD, PhD, Yoshiaki Takewa, MD, PhD, Shunei Kyo, MD, PhD, Minoru Ono, MD, PhD, Yoshiyuki Taenaka, MD, PhD, and Eisuke Tatsumi, MD, PhD, Tokyo, Japan*

For successful device LVAD removal, appropriate patient selection and precise evaluation of cardiac function are essential. We developed a novel “off-test mode” for rotary LVAD weaning, which increases revolutions per minute just in diastole. The EVAHEART device was installed in 8 goats, and we evaluated LV workload and retrograde pump flow under 3 conditions: circuit clamp, continuous mode, and off-test mode. Off-test mode decreased retrograde pump flow during weaning while keeping LV workload similar to circuit clamp. This mode is potentially valuable for establishing a safe and appropriate pump weaning protocol after myocardial recovery.

## Cardiothoracic Transplantation (TX)

## 1183 Outcomes after transplantation for “failed” Fontan: A single-institution experience

*Ryan R. Davies, MD, Robert A. Sorabella, MD, Jonathan Yang, MD, Ralph S. Mosca, MD, Jonathan M. Chen, MD, and Jan M. Quaegebeur, MD, PhD, Wilmington, Del, and New York, NY*

An analysis of 43 patients undergoing transplantation for “failed” Fontan from a single institution was undertaken to assess the pretransplantation predictors of post-transplant survival. Early mortality was greater among Fontan patients than patients with other congenital heart disease, and renal failure was the strongest predictor of early mortality.

## 1193 Benefits of ambulatory axillary intra-aortic balloon pump for circulatory support as bridge to heart transplant

*Ramanan Umakanthan, MD, Steven J. Hoff, MD, Natalia Solenkova, MD, Mark A. Wigger, MD, Mary E. Keebler, MD, Andrew Lenneman, MD, Marzia Leacche, MD, Thomas G. DiSalvo, MD, Henry Ooi, MD, Allen J. Naftilan, MD, John G. Byrne, MD, and Rashid M. Ahmad, MD, Nashville, Tenn*

Axillary intra-aortic balloon pump therapy has been described as a bridge to transplant. Advantages over femoral intra-aortic balloon pump therapy include enhanced mobility. We conducted a study to evaluate outcomes in selected patients and observed marked improvement in ambulatory potential and hemodynamic parameters. The majority of patients were successfully bridged to transplantation.

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## Perioperative Management (PM)

### 1198 Intraoperative use of recombinant activated factor VII during complex aortic surgery

*Deniz Goksedef, MD, Georgia Panagopoulos, PhD, Naiem Nassiri, MD, Randy L. Levine, MD, Panagiotis G. Hountis, MD, and Konstadinos A. Plestis, MD, New York, NY*

Recombinant activated factor VII is increasingly used for the postoperative management of bleeding in cardiac surgery. We report our experience with the intraoperative use of this agent after aortic surgery.

### 1205 Selective cerebral perfusion for thoracic aortic surgery: Association with neurocognitive outcome

*Suzan Uysal, PhD, Hung-Mo Lin, PhD, Gregory W. Fischer, MD, Gabriele Di Luozzo, MD, and David L. Reich, MD, New York, NY*

Neurocognitive outcomes were studied in 57 adult patients undergoing cardiac or other thoracic aortic surgery with different methods of neuroprotection. Duration of antegrade selective cerebral perfusion was a significant predictor of decline in memory and language test scores.

### 1213 Recognition of heparin-induced thrombocytopenia and initiation of argatroban therapy after cardiothoracic surgery in the intensive care unit

*Linda J. Demma, MD, PhD, Christopher A. Paciullo, PharmD, BCPS, and Jerrold H. Levy, MD, FAHA, Atlanta, Ga*

Current data regarding the safety of argatroban in the postoperative cardiothoracic surgical patient in the intensive care setting are limited. The results from this study demonstrate that argatroban can be considered without increased risk for adverse events in the cardiothoracic intensive care unit after surgery on clinical suspicion of heparin-induced thrombocytopenia.

## Cardiothoracic Imaging

### 1219 Titanium plates for primary closure of complete sternal cleft in an adult: Five-year follow-up

*Khaled E. Al-Ebrahim, FRCSC, and Husain H. Jabbad, FRCSC, Jeddah, Saudi Arabia*

## Surgical Techniques

### 1221 Adult extracorporeal membrane oxygenation and gastrointestinal bleeding from small bowel arteriovenous malformations: A novel treatment using spiral enteroscopy

*Konrad Sarosiek, MD, Hitoshi Hirose, MD, Harrison T. Pitcher, MD, and Nicholas C. Cavarocchi, MD, Philadelphia, Pa*

### 1223 Middle and posterior cardiac veins: An underused option for ventricular pacing

*Henry M. Spotnitz, MD, and Daniel Y. Wang, MD, New York, NY*

### 1225 Early experience with the transaortic approach for transcatheter aortic valve implantation

*Gopal Soppa, MRCS, PhD, David Roy, MD, Stephen Brecker, FRCP, and Marjan Jahangiri, FRCS (CTh), London, United Kingdom*

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## 1227 Carotid artery and jugular vein cannulation in aortic redo surgery



Paul P. Urbanski, MD, PhD, Bad Neustadt, Germany

### Online Only: Case Reports

## e41 Quantitative assessment of right ventricular function in pectus excavatum

Rajeev L. Narayan, MD, Prashant Vaishnava, MD, Jose M. Castellano, MD, PhD, and Valentin Fuster, MD, PhD, New York, NY, and Madrid, Spain

## e42 A new echocardiographic window to visualize the mitral valve complex during mitral valve repair for functional mitral regurgitation

Kikuko Obase, MD, PhD, Masashi Komeda, MD, PhD, Hiroyuki Okura, MD, PhD, and Kiyoshi Yoshida, MD, PhD, Kurashiki and Nagoya, Japan

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## 1230 Open versus endovascular repair for acute traumatic thoracic aortic rupture

Alain Verdant, MD, Montréal, Quebec, Canada

## 1230 Reply to the Editor

Ludovic Canaud, MD, and Pierre Alric, MD, PhD, Montpellier, France

## 1231 Does anastomosis device or epiaortic ultrasonography reduce the risk of postoperative stroke after coronary artery bypass grafting?

Fausto Biancari, MD, PhD, Oulu, Finland

## 1232 Reply to the Editor

Maximilian Y. Emmert, MD, Sacha P. Salzberg, MD, and Volkmar Falk, MD, Zurich, Switzerland

## 1232 Simulation of thoracoscopic surgery using 3-dimensional tailor-made virtual lung

Tadashi Akiba, MD, Toshiaki Morikawa, MD, and Takao Ohki, MD, Kashiwa, Chiba, and Minatoku, Tokyo, Japan

## 1234 Guiding the molecular diagnosis of hypertrophic cardiomyopathy

Christian Geier, MD, Eric Schulze-Bahr, MD, and Gisèle Bonne, PhD, Berlin and Münster, Germany; and Paris, France

## 1234 Re: Simplified perfusion strategy for removing retroperitoneal tumors with extensive cavoatrial involvement

Javier González, MD, Thomas Salerno, MD, and Gaetano Ciancio, MD, Madrid, Spain, and Miami, Fla

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## Notices of Correction

- 1235** Correction of article by Akins CW, entitled The ethical dilemma of Thoracic Surgery recertification (2012;143:521-2).
- 1235** Correction of article by Hillis LD, Smith PK, Anderson JL, Bittl JA, Bridges CR, Byrne JG, Cigarroa JE, DiSesa VJ, Hiratzka LF, Hutter AM Jr, Jessen ME, Keeley EC, Lahey SJ, Lange RA, London MJ, Mack MJ, Patel MR, Puskas JD, Sabik JF, Selnes O, Shahian DM, Trost JC, Winniford MD, entitled 2011 ACCF/AHA guideline for coronary artery bypass graft surgery: Executive summary: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. (2012;143:4-34).

## Announcements

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- 1236** 2012 Heart Failure Summit
- 1237** AATS Online Award Applications

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